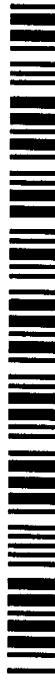


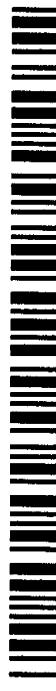
UNITED STATES PATENT AND TRADEMARK OFFICE
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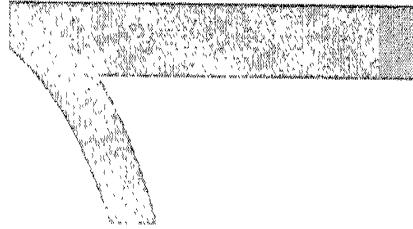
371 Application As Filed

Level - 1
Version 1.1
Updated - 8/01/01
Set updated 3/01/02

UNITED STATES PATENT AND TRADEMARK OFFICE
DOCUMENT CLASSIFICATION BARCODE SHEET



Transmittal



Level - 2
Version 1.1
Updated - 8/01/01

**U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE**

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

TITLE OF INVENTION
ELECTRICAL PLUG CONNECTION

APPLICANT(S) FOR DO/EO/US
MAUÉ, Hans-Heinrich, HOFMEISTER, Werner; SHOENFELD, Michael; SIMMEL, Andreas

Applicant(s) herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information

1. This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
 2. This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
 - 3 This is an express request to begin national examination procedures (35 U.S.C. 371(f)) immediately rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b), and PCT Articles 22 and 39(1).
 4. A Proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
 5. A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. has been transmitted by the International Bureau.
 - c. is not required, as the application was filed in the United States Receiving Office (RO/US)
 6. A translation of the International Application into English (35 U.S.C. 371(c)(2)).
 - 7 Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. have been transmitted by the International Bureau.
 - c. have not been made, however, the time limit for making such amendments has NOT expired
 - d. have not been made and will not be made
 8. A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
 - 9 An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)) UNSIGNED.
 10. A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).
- Items 11. to 16. below concern other documents(s) or information included:**
11. An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
 12. An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
 13. A **FIRST** preliminary amendment.
 - A **SECOND** or **SUBSEQUENT** preliminary amendment.
 14. A substitute specification and marked-up version of substitute specification.
 15. A change of power of attorney and/or address letter.
 16. Other items or information: International Search Report, and PCT/RO/101.

U.S. APPLICATION NO. 107009243 INTERNATIONAL APPLICATION NO. PCT/DE01/01147

SEARCH REQUEST NUMBER
10191/2141

SEARCH REQUEST NUMBER
10191/2141

17. The following fees are submitted:

Basic National Fee (37 CFR 1.492(a)(1)-(5)):

Search Report has been prepared by the EPO or JPO

International preliminary examination fee paid to USPTO (37 CFR 1.482) \$890.00

No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) \$710.00

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$1,040.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) \$740.00

ENTER APPROPRIATE BASIC FEE AMOUNT = \$ 890

Surcharge of \$130.00 for furnishing the oath or declaration later than 20 30 months from the earliest claimed priority date (37 CFR 1.492(e)).

Claims	Number Filed	Number Extra	Rate
Total Claims	6 - 20 =	0	X \$18.00
Independent Claims	1 - 3 =	0	X \$84.00
Multiple dependent claim(s) (if applicable)			+ \$280.00
TOTAL OF ABOVE CALCULATIONS =			\$890
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity statement must also be filed. (Note 37 CFR 1.9.1.27. 1.28).			\$
SUBTOTAL =			\$890
Processing fee of \$130.00 for furnishing the English translation later the <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492(f)).			\$
TOTAL NATIONAL FEE =			\$890
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property + \$			\$
TOTAL FEES ENCLOSED =			\$890
Amount to be: refunded \$ charged \$			

- a. A check in the amount of \$ _____ to cover the above fees is enclosed.
- b. Please charge my Deposit Account No. 11-0600 in the amount of \$890.00 to cover the above fees. A duplicate copy of this sheet is enclosed.
- c. The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 11-0600. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:
Kenyon & Kenyon
One Broadway
New York, New York 10004

SIGNATURE

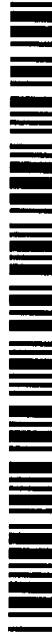
Richard L. Mayer, Reg. No. 22,490

NAME

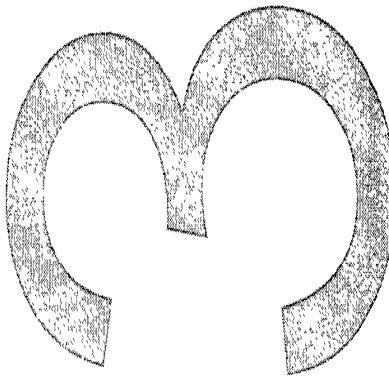
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10/16/01

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Preliminary Amendments



Level - 2
Version 1.1
Updated - 8/01/01

101009243
JC13 Rec'd PCT/PTO 06 DEC 2001

[10191/2141]

#36

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s) : Hans-Heinrich MAUER et al.
Serial No. : To Be Assigned
Filed : Herewith
For : ELECTRICAL PLUG CONNECTION
Art Unit : To Be Assigned
Examiner : To Be Assigned
Assistant Commissioner for Patents
Washington, D.C. 20231

**PRELIMINARY AMENDMENT AND
37 C.F.R. § 1.125 SUBSTITUTE SPECIFICATION STATEMENT**

SIR:

Please amend the above-identified application before examination, as set forth below.

IN THE SPECIFICATION AND ABSTRACT:

In accordance with 37 C.F.R. § 1.121(b)(3), a Substitute Specification (including the Abstract, but without claims) accompanies this response. It is respectfully requested that the Substitute Specification (including Abstract) be entered to replace the Specification of record.

IN THE CLAIMS:

Please cancel claims 1-6, without prejudice.

Please add the following new claims:

7. (New) An electrical plug connection comprising:
 - first and second connectors adapted to be detachably coupled to one another in an axially running plug direction, the first connector including a housing;
 - a receiving slot formed in the housing of the first connector;
 - a flange protruding at the second connector, the flange at least regionally engaging with the receiving slot when the first and second connectors are coupled, the flange having an end face and having a side surface;

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- a seal attached to the first connector, the seal being elastically deformed by the flange when the first and second connectors are coupled;
- at least one first pressing element radially pressed against the side surface of the flange when the first and second connectors are coupled, the first pressing element projecting radially, transversely to the plug direction, into the receiving slot; and
- at least one second pressing element receiving the end face of the flange under axially directed pressing tension at an end of a coupling operation of the first and second connectors, the second pressing element being situated in the receiving slot..
8. (New) The plug connection according to claim 7, further comprising a contact carrier, and wherein the first pressing element forms one piece with the contact carrier as part of the housing of the first connector and is composed of an inherently stable plastic.
9. (New) The plug connection according to claim 8, wherein the first pressing element extends around the contact carrier.
10. (New) The plug connection according to claim 8, wherein a circumferential extent of the first pressing element at the contact carrier is partially interrupted and forms individual pressing regions that can alternatively be re-formed into individual pressing points.
11. (New) The plug connection according to claim 8, wherein the second pressing element is situated at a closed end of the receiving slot and is formed in the contact carrier as a circumferential ring composed of an elastic material having a Shore hardness of at least 60.
12. (New) The plug connection according to claim 11, wherein the second pressing element is formed from hard rubber.

Remarks

This Preliminary Amendment cancels without prejudice claims 1-6 in the underlying PCT Application No. PCT/DE01/01147, and adds without prejudice new claims 7- 12 . The new claims conform the claims to U.S. Patent and Trademark Office rules and do not add new matter to the application.

In accordance with 37 C.F.R. § 1.121(b)(3), the Substitute Specification (including the Abstract, but without the claims) contains no new matter. The amendments reflected in the Substitute Specification (including Abstract) are to conform the Specification and Abstract to U.S. Patent and Trademark Office rules or to correct informalities. As required by 37 C.F.R. § 1.121(b)(3)(iii) and § 1.125(b)(2), a Marked Up Version Of The Substitute Specification comparing the Specification of record and the Substitute Specification also accompanies this Preliminary Amendment. Approval and entry of the Substitute Specification (including Abstract) is respectfully requested.

The underlying PCT Application No. PCT/DE01/01147 includes an International Search Report, dated August 21, 2001. The Search Report includes a list of documents that were uncovered in the underlying PCT Application. A copy of the Search Report accompanies this Preliminary Amendment.

Applicants assert that the subject matter of the present application is new, non-obvious, and useful. Prompt consideration and allowance of the application are respectfully requested.

Respectfully Submitted,

KENYON & KENYON
By: *[Signature]* No 25252
By: *[Signature]*
Richard L. Mayer
(Reg. No. 22,490)

Dated: 12/6/01

One Broadway
New York, NY 10004
(212) 425-7200

[101912141]

ELECTRICAL PLUG CONNECTION

Background Information

[The present invention is based on an electrical plug connection according to the species defined in Claim 1.] An electrical plug connection having two connectors that can be detachably coupled to one another is known from German Patent No. DE 41 15 119 [C2].

The first connector has a contact carrier. Formed in the contact carrier are receiving chambers in which in each case one contact element is located. The contact elements are each connected via a connection segment to a cable. Clustered as a cable harness, the cables are brought out of the first connector on the reverse side. In a closed plug connection, the contact elements are electroconductively connected via contact segments to the appropriate contact parts of the second connector.

To seal the plug connection between the connectors, a sealing ring of an elastic material runs around the outside of the contact carrier of the first connector, the sealing ring engaging with a side surface of a sleeve-shaped flange of the second connector and deforming in a resilient manner when the two connectors are joined.

If such a plug connection is used in a motor vehicle, the connection is stressed during the operation of the motor vehicle by vibrational stresses, and relative movements occur between the two connectors since they are elastically coupled via the seal. These relative movements also occur between the contact elements of the first connector and the contact parts of the second connector, and they can result in the touching contact surfaces of the contact elements and the contact parts wearing through. The contacting is then carried out via the less effective contacting carrier material of these elements, thereby no longer ensuring the contact reliability of the plug connection. As a result, the performance reliability of the plug connection is undesirably affected.

MARKED-UP VERSION OF SUBSTITUTE SPECIFICATION

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Summary [of the] Of The Invention

[In comparison with the related art, the] The plug connection according to the present invention [and having the characterizing features of Claim 1] has the advantage that the previously mentioned shortcomings are avoided.

For this purpose, a first pressing element, which is radially pressed against the flange of the mating connector, as well as a second pressing element, which receives an end face of the flange under an axially directed pressing tension at the 10 end of the coupling process of the two connectors, are attached to the first connector in addition to the sealing element. The clearance of motion that was unavoidable in the case of the related art due to the deformability of the sealing element needed for functionality is eliminated by the pressing elements. As a result, the two connectors behave in a coupled state as if they were one piece. This 15 transfers to the contact elements and contact parts situated in the fixed connectors, thereby producing a stable connection.

Due to this formation of the connectors, the vibrational stresses introduced to the contact elements and contact parts are advantageously reduced to the extent that they no longer jeopardize the functionality of the plug connection.

[Advantageous measures for implementing the present invention are specified in the dependent claims.]

25 Brief Description of the Drawing

An exemplary embodiment of the present invention is represented in the drawing and explained in detail in the following description.] Brief Description Of The Drawings

Figure 1 shows a sectional view of a first connector coupled with a second

MARKE-D-UP VERSION OF SUBSTITUTE SPECIFICATION

connector to form an electrical plug connection.

Figure 2 shows an enlarged section of Figure 1.

- 5 **Detailed Description [of the Exemplary Embodiment]**
An electrical plug connection 11 shown in Figures 1[,] and 2 has a first connector 12 and a second connector 13. First connector 12 is configured as a movable cable-harness plug, while second connector 13 is attached in a stationary manner as a attachment plug to an electrical aggregate, in particular to a diesel injection pump. Connectors 12, 13 are detachably coupled to one another.
- 10 First connector 12 has a housing 14 formed as a grip-type shell, which is formed as a contact carrier 15 on the inside. As the rest of housing 14, contact carrier 15 is made of an electrically insulating plastic and includes a number of receiving chambers 16 corresponding to the pole number of first connector 12, the receiving chambers penetrating contact carrier 15 in the axial direction, along an arrow 17. Inserted in the direction of arrow 17 in every receiving chamber 16 is a contact element 18, which is only schematically represented.
- 15 At one end, contact element 18 has a contact segment 19, via which contact element 18 contacts an associated contact part 21 of second connector 13. Formed at the other end of contact element 18 is a fastening segment 22, to which an electric cable 23 is attached in an electrically contacting manner, the cable, upon emerging from contact carrier 14, being combined in a manner not shown with the other cables of the other contact elements 18 to form a cable harness.
- 20 Formed in contact carrier 15 as part of housing 14 is an axially directed, circumferential receiving slot 24 for accommodating an end segment of a corresponding flange 26 of second connector 13 when joining both connectors 12, 13. To seal plug connection 11 between connectors 12, 13, a seal 27 is attached to
- 25

MARKE-D-UP VERSION OF SUBSTITUTE SPECIFICATION

contact carrier 15.

To form a radial seal, seal 27 has a plurality of circumferential, radially directed sealing lips 28, which are axially offset from one another.

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When joining both connectors 12, 13, sealing lips 28 are gripped by sleeve-shaped flange 26 of second connector 13 and are partially resiliently deflected at a side surface 29 of flange 26 in the axial direction, in the opposite direction of arrow 17. Thus, both connectors 12, 13 are sealed relative to each other by seal 27.

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In accordance with the deformability necessary for functionality, seal 27 is made of a soft, elastic material, so that given vibrational stresses of plug connection 11, the seal is not able to prevent undesired relative movements between coupled connectors 12, 13 due to vibrational stresses and due to the different masses of both connectors 12, 13.

To rigidly couple connectors 12, 13 also under vibrational stresses, a first pressing element 31 and a second pressing element 32 are provided. First pressing element 31, which is represented in the figures in a superelevated manner, is formed as a circumferential protuberance of contact carrier 15, which is made of an inherently stable plastic, and forms one piece with the contact carrier. In this context, the pressing element protrudes from a sidewall 33 of contact carrier 15 in a radial direction and partially projects into receiving slot 24 such that when inserting flange 26 into receiving slot 24, the pressing element is radially pressed against side surface 29 in the end segment of flange 26.

Alternatively, the circumferential extent of first pressing element 31 can be partially interrupted and can form single pressing regions, the pressing regions also being able to be re-formed into individual pressing points, so-called pressing warts.

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Second pressing element 32 is situated at the closed end of receiving slot 24 and is formed as a circumferential ring having rectangular cross-sectional areas. Second pressing element 32 is made of a hard rubber and has a Shore hardness of at least 60. At the end of the coupling operation of both connectors 12, 13, second pressing element 32 receives an end face 34 at the free end of flange 26 under axially directed pressing tension.

As a result of pressing elements 31, 32, both connectors 12, 13 are radially as well as axially biased relatively to each other after the completed coupling process. In this manner, both connectors 12, 13 form a one-piece unit, which can, however, be detached as needed. This one-piece design (integral formation) transfers to contact elements 18 and contact parts 21, which are situated in connectors 12, 13, and whose connection is fixed in the same manner.

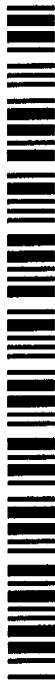
As a result of contact elements 18 being connected in a stable manner to contact parts 21, functionality-threatening relative movements between contact elements 18 and contact parts 21 in response to vibrational stresses acting on plug connection 11 are reduced to being uncritical, so that plug connection 11 remains functionally stable even under these unfavorable operating conditions. As a result, it is possible to attach plug connection 11 directly to an aggregate of an internal combustion engine.

Abstract Of The Disclosure

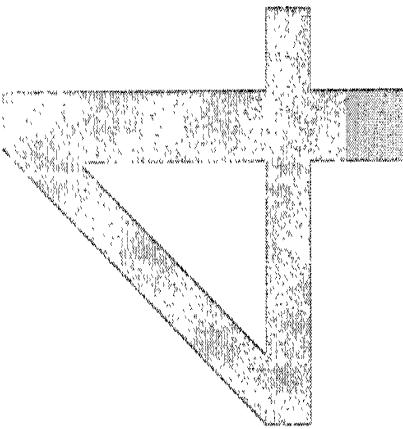
A multipole electrical plug connection [is to be designed in such a manner that it] remains functionally stable even under vibrational stresses, in particular during the operation of an internal combustion engine. [

The plug connection [(11)] is formed by coupling a first connector [(12)] to a second connector [(13)]. Attached to a contact carrier [(15)] as part of a housing [(14)] of the first connector [(12)] are a first pressing element [(31)] and a second pressing element [(32)], via which the two connectors [(12, 13)] are radially and axially biased when both connectors [(12, 13)] are joined. As a result, relative movements between the contacted contact elements [(18)] and contact parts [(21)] situated in the fixed connectors [(12, 13)] are prevented. [The plug connection [(11)] is preferably intended for use in automobile manufacturing.

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Specification



Level - 2
Version 1.1
Updated - 8/01/01

ELECTRICAL PLUG CONNECTION

Background Information

An electrical plug connection having two connectors that can be detachably coupled to one another is known from German Patent No. DE 41 15 119.

- The first connector has a contact carrier. Formed in the contact carrier are receiving chambers in which in each case one contact element is located. The contact elements are each connected via a connection segment to a cable. Clustered as a cable harness, the cables are brought out of the first connector on the reverse side. In a closed plug connection, the contact elements are electroconductively connected via contact segments to the appropriate contact parts of the second connector.

To seal the plug connection between the connectors, a sealing ring of an elastic material runs around the outside of the contact carrier of the first connector, the sealing ring engaging with a side surface of a sleeve-shaped flange of the second connector and deforming in a resilient manner when the two connectors are joined.

If such a plug connection is used in a motor vehicle, the connection is stressed during the operation of the motor vehicle by vibrational stresses, and relative movements occur between the two connectors since they are elastically coupled via the seal. These relative movements also occur between the contact elements of the first connector and the contact parts of the second connector, and they can result in the touching contact surfaces of the contact elements and the contact parts wearing through. The contacting is then carried out via the less effective contacting carrier material of these elements, thereby no longer ensuring the contact reliability of the plug connection. As a result, the performance reliability of the plug connection is undesirably affected.

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SUBSTITUTE SPECIFICATION

Summary Of The Invention

The plug connection according to the present invention has the advantage that the previously mentioned shortcomings are avoided.

- 5 For this purpose, a first pressing element, which is radially pressed against the flange of the mating connector, as well as a second pressing element, which receives an end face of the flange under an axially directed pressing tension at the end of the coupling process of the two connectors, are attached to the first connector in addition to the sealing element. The clearance of motion that was unavoidable in the case of the related art due to the deformability of the sealing element needed for functionality is eliminated by the pressing elements. As a result, the two connectors behave in a coupled state as if they were one piece. This transfers to the contact elements and contact parts situated in the fixed connectors, thereby producing a stable connection.
- 10 Due to this formation of the connectors, the vibrational stresses introduced to the contact elements and contact parts are advantageously reduced to the extent that they no longer jeopardize the functionality of the plug connection.
- 15 Brief Description Of The Drawings
Figure 1 shows a sectional view of a first connector coupled with a second connector to form an electrical plug connection.
- 20 Figure 2 shows an enlarged section of Figure 1.
- 25 Detailed Description
An electrical plug connection 11 shown in Figures 1 and 2 has a first connector 12 and a second connector 13. First connector 12 is configured as a movable cable-harness plug, while second connector 13 is attached in a stationary manner as a attachment plug to an electrical aggregate, in particular to a diesel injection

SUBSTITUTE SPECIFICATION

pump. Connectors 12, 13 are detachably coupled to one another.

First connector 12 has a housing 14 formed as a grip-type shell, which is formed as a contact carrier 15 on the inside. As the rest of housing 14, contact carrier 15 is made of an electrically insulating plastic and includes a number of receiving chambers 16 corresponding to the pole number of first connector 12, the receiving chambers penetrating contact carrier 15 in the axial direction, along an arrow 17. Inserted in the direction of arrow 17 in every receiving chamber 16 is a contact element 18, which is only schematically represented.

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At one end, contact element 18 has a contact segment 19, via which contact element 18 contacts an associated contact part 21 of second connector 13. Formed at the other end of contact element 18 is a fastening segment 22, to which an electric cable 23 is attached in an electrically contacting manner, the cable, upon emerging from contact carrier 14, being combined in a manner not shown with the other cables of the other contact elements 18 to form a cable harness.

Formed in contact carrier 15 as part of housing 14 is an axially directed, circumferential receiving slot 24 for accommodating an end segment of a corresponding flange 26 of second connector 13 when joining both connectors 12, 13. To seal plug connection 11 between connectors 12, 13, a seal 27 is attached to contact carrier 15.

To form a radial seal, seal 27 has a plurality of circumferential, radially directed sealing lips 28, which are axially offset from one another.

When joining both connectors 12, 13, sealing lips 28 are gripped by sleeve-shaped flange 26 of second connector 13 and are partially resiliently deflected at a side surface 29 of flange 26 in the axial direction, in the opposite direction of arrow 17. Thus, both connectors 12, 13 are sealed relative to each other by seal 27.

SUBSTITUTE SPECIFICATION

In accordance with the deformability necessary for functionality, seal 27 is made of a soft, elastic material, so that given vibrational stresses of plug connection 11, the seal is not able to prevent undesired relative movements between coupled connectors 12, 13 due to vibrational stresses and due to the different masses of both connectors 12, 13.

To rigidly couple connectors 12, 13 also under vibrational stresses, a first pressing element 31 and a second pressing element 32 are provided. First pressing element 31, which is represented in the figures in a superellevated manner, is formed as a circumferential protuberance of contact carrier 15, which is made of an inherently stable plastic, and forms one piece with the contact carrier. In this context, the pressing element protrudes from a sidewall 33 of contact carrier 15 in a radial direction and partially projects into receiving slot 24 such that when inserting flange 26 into receiving slot 24, the pressing element is radially pressed against side surface 29 in the end segment of flange 26.

Alternatively, the circumferential extent of first pressing element 31 can be partially interrupted and can form single pressing regions, the pressing regions also being able to be re-formed into individual pressing points, so-called pressing warts.

Second pressing element 32 is situated at the closed end of receiving slot 24 and is formed as a circumferential ring having rectangular cross-sectional areas. Second pressing element 32 is made of a hard rubber and has a Shore hardness of at least 60. At the end of the coupling operation of both connectors 12, 13, second pressing element 32 receives an end face 34 at the free end of flange 26 under axially directed pressing tension.

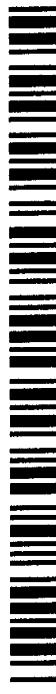
As a result of pressing elements 31, 32, both connectors 12, 13 are radially as well as axially biased relatively to each other after the completed coupling process. In this manner, both connectors 12, 13 form a one-piece unit, which can, however, be

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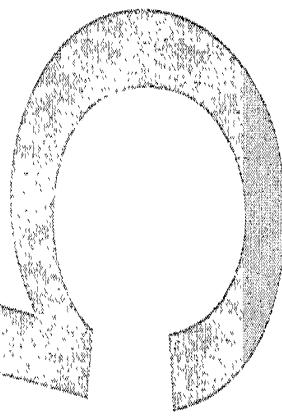
detached as needed. This one-piece design (integral formation) transfers to contact elements 18 and contact parts 21, which are situated in connectors 12, 13, and whose connection is fixed in the same manner.

- 5 As a result of contact elements 18 being connected in a stable manner to contact parts 21, functionality-threatening relative movements between contact elements 18 and contact parts 21 in response to vibrational stresses acting on plug connection 11 are reduced to being uncritical, so that plug connection 11 remains functionally stable even under these unfavorable operating conditions. As a result, it is possible to attach plug connection 11 directly to an aggregate of an internal combustion engine.
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Claims



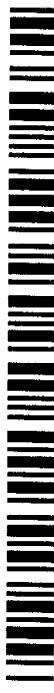
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Updated - 8/01/01

What is claimed is:

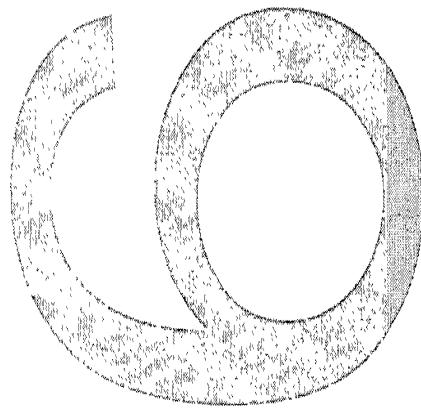
1. An electrical plug connection having a first connector (12) and a second connector (13), which can be detachably coupled to one another in an axially running plug direction, a receiving slot (24) formed in a housing (14) of the first connector part (12), a flange (26), which protrudes at the second connector (13), at least regionally engaging with the receiving slot (24) when the two connector parts (12, 13) are coupled, and having a seal (27), which is attached to the first connector (12) and is elastically deformed by the flange (26) when the two connectors (12, 13) are coupled,
wherein at least a first pressing element (31), which is radially pressed against a side surface (29) of the flange (26) when the two connectors (12, 13) are coupled, projects radially, transversely to the plug direction, into the receiving slot (24); and at least a second pressing element (32), which receives an end face (34) of the flange (26) under axially directed pressing tension at the end of the coupling operation of the two connectors (12, 13), is situated in the receiving slot (24).
2. The plug connection as recited in Claim 1,
wherein the first pressing element (31) forms one piece with a contact carrier (15) as part of the housing (14) of the first connector (12) and is made of an inherently stable plastic.
3. The plug connection as recited in Claim 2,
wherein the first pressing element (31) runs around the contact carrier (15).
4. The plug connection as recited in Claim 2,
wherein the circumferential extent of first pressing element (31) at the contact carrier (15) is partially interrupted and forms individual pressing regions that can alternatively be re-formed into individual pressing points.

5. The plug connection as recited in one of the preceding claims, wherein the second pressing element (32) is situated at the closed end of the receiving slot (24) and is formed in the contact carrier (15) as a circumferential ring made of a hard elastic material having a Shore hardness of at least 60.
6. The plug connection as recited in Claim 5, wherein the second pressing element (32) is formed from hard rubber.

UNITED STATES PATENT AND TRADEMARK OFFICE
DOCUMENT CLASSIFICATION BARCODE SHEET



Abstract



Level - 2
Version 1.1
Updated - 8/01/01

Abstract Of The Disclosure

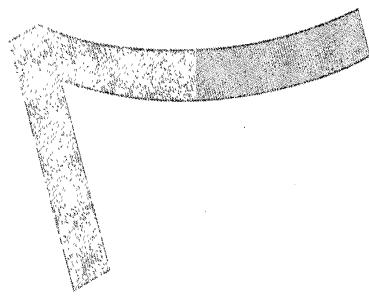
A multipole electrical plug connection remains functionally stable even under vibrational stresses, in particular during the operation of an internal combustion engine. The plug connection is formed by coupling a first connector to a second connector. Attached to a contact carrier as part of a housing of the first connector are a first pressing element and a second pressing element, via which the two connectors are radially and axially biased when both connectors are joined. As a result, relative movements between the contacted contact elements and contact parts situated in the fixed connectors are prevented. The plug connection is preferably intended for use in automobile manufacturing.

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Drawings



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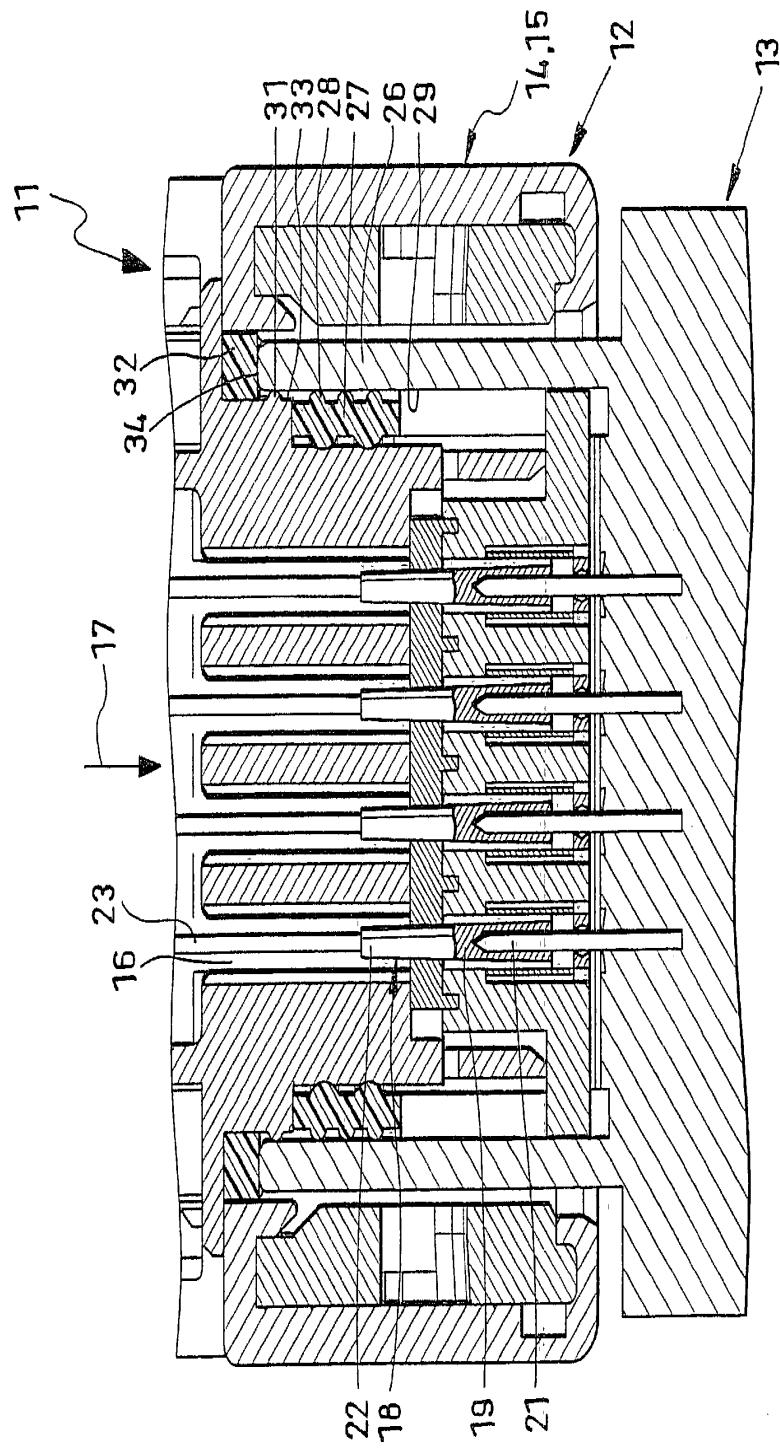


Fig. 1

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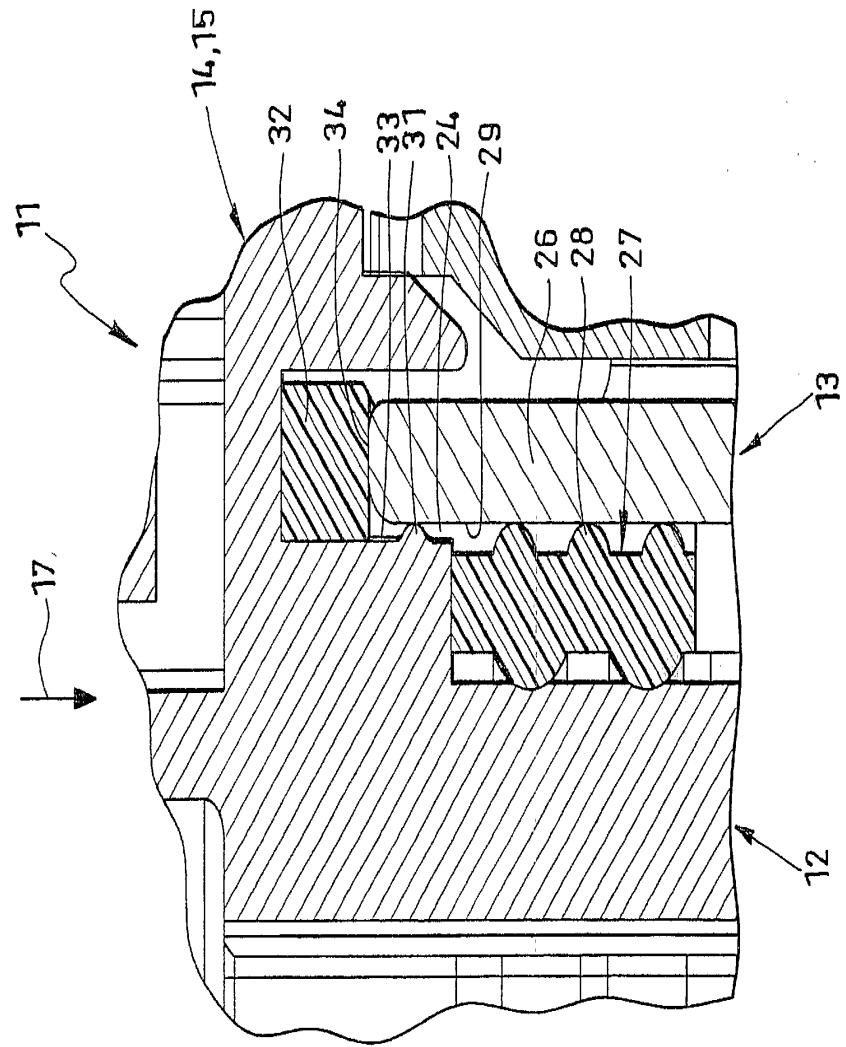
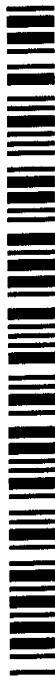
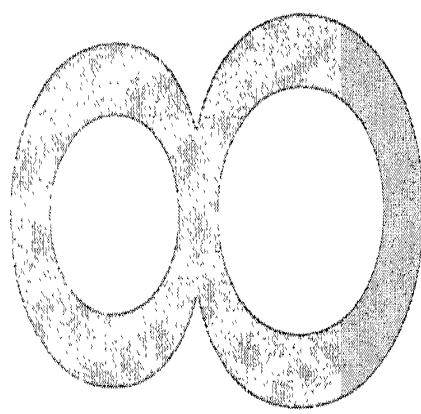


Fig. 2

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Oath/Declaration, Small Entity,
and Power of Attorney



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#2

COMBINED DECLARATION AND
POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below adjacent to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled "**ELECTRICAL PLUG CONNECTION**", and the specification of which:

[] is attached hereto;

[] was filed as United States Application Serial No. _____ on _____, _____ and was amended by the Preliminary Amendment filed on _____, _____

was filed as PCT International Application Number
PCT/D^EO1/01147, on the 24th day of March 2001.

[X] an English translation of which is filed herewith.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56(a). I hereby claim foreign priority benefits under Title 35, United States Code § 119 of any foreign application(s) for patent or inventor's certificate or of any PCT international applications(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

2003621908

10191/2141

**PRIOR FOREIGN/PCT APPLICATION(S)
AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. § 119**

Country : Germany

Application No. : 200 06 550.5

Date of Filing: April 8, 2000

Priority Claimed
Under 35 U.S.C. § 119 : Yes No

I hereby claim the benefit under Title 35, United States Code § 120 of any United States Application or PCT International Application designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations § 1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

**PRIOR U.S. APPLICATIONS OR
PCT INTERNATIONAL APPLICATIONS
DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. § 120**

U.S. APPLICATIONS

Number :

Filing Date :

**PCT APPLICATIONS
DESIGNATING THE U.S.**

PCT Number :

PCT Filing Date :

I hereby appoint the following attorney(s) and/or agents to prosecute the above-identified application and transact all business in the Patent and Trademark Office connected therewith.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.



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PATENT TRADEMARK OFFICE

1-00

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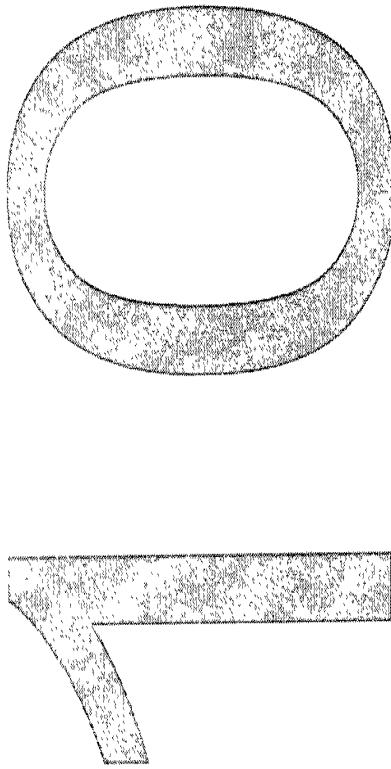
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ELECTRICAL PLUG CONNECTION

Background Information

The present invention is based on an electrical plug connection according to the species defined in Claim 1. An electrical plug connection having two connectors that can be detachably coupled to one another is known from DE 41 15 119 C2.

The first connector has a contact carrier. Formed in the contact carrier are receiving chambers in which in each case one contact element is located. The contact elements are each connected via a connection segment to a cable. Clustered as a cable harness, the cables are brought out of the first connector on the reverse side. In a closed plug connection, the contact elements are electroconductively connected via contact segments to the appropriate contact parts of the second connector.

To seal the plug connection between the connectors, a sealing ring of an elastic material runs around the outside of the contact carrier of the first connector, the sealing ring engaging with a side surface of a sleeve-shaped flange of the second connector and deforming in a resilient manner when the two connectors are joined.

If such a plug connection is used in a motor vehicle, the connection is stressed during the operation of the motor vehicle by vibrational stresses, and relative movements occur between the two connectors since they are elastically coupled via the seal. These relative movements also occur between the contact elements of the first connector and the contact parts of the second connector, and they can result in the touching contact surfaces of the contact elements and the contact parts wearing through. The contacting is then carried out via the less effective contacting carrier material of these elements, thereby no longer ensuring the contact reliability of the plug connection. As a result, the performance reliability of the plug connection is undesirably affected.

Summary of the Invention

In comparison with the related art, the plug connection according to the present invention and having the characterizing features of Claim 1 has the advantage that the previously mentioned shortcomings are avoided.

For this purpose, a first pressing element, which is radially pressed against the flange of the mating connector, as well as a second pressing element, which receives an end face of the flange under an axially directed pressing tension at the end of the coupling process of the two connectors, are attached to the first connector in addition to the sealing element. The clearance of motion that was unavoidable in the case of the related art due to the deformability of the sealing element needed for functionality is eliminated by the pressing elements. As a result, the two connectors behave in a coupled state as if they were one piece. This transfers to the contact elements and contact parts situated in the fixed connectors, thereby producing a stable connection.

Due to this formation of the connectors, the vibrational stresses introduced to the contact elements and contact parts are advantageously reduced to the extent that they no longer jeopardize the functionality of the plug connection.

Advantageous measures for implementing the present invention are specified in the dependent claims.

25 Brief Description of the Drawing

An exemplary embodiment of the present invention is represented in the drawing and explained in detail in the following description. Figure 1 shows a sectional view of a first connector coupled with a second connector to form an electrical plug connection. Figure 2 shows an enlarged section of Figure 1.

Description of the Exemplary Embodiment

An electrical plug connection 11 shown in Figures 1, 2 has a first connector 12 and a second connector 13. First connector 12 is configured as a movable cable-harness plug, while second connector 13 is attached in a stationary manner as a attachment plug to an electrical aggregate, in particular to a diesel injection pump. Connectors 12, 13 are detachably coupled to one another.

- First connector 12 has a housing 14 formed as a grip-type shell, which is formed as a contact carrier 15 on the inside. As the rest of housing 14, contact carrier 15 is made of an electrically insulating plastic and includes a number of receiving chambers 16 corresponding to the pole number of first connector 12, the receiving chambers penetrating contact carrier 15 in the axial direction, along an arrow 17. Inserted in the direction of arrow 17 in every receiving chamber 16 is a contact element 18, which is only schematically represented.
- At one end, contact element 18 has a contact segment 19, via which contact element 18 contacts an associated contact part 21 of second connector 13. Formed at the other end of contact element 18 is a fastening segment 22, to which an electric cable 23 is attached in an electrically contacting manner, the cable, upon emerging from contact carrier 14, being combined in a manner not shown with the other cables of the other contact elements 18 to form a cable harness.

- Formed in contact carrier 15 as part of housing 14 is an axially directed, circumferential receiving slot 24 for accommodating an end segment of a corresponding flange 26 of second connector 13 when joining both connectors 12, 13. To seal plug connection 11 between connectors 12, 13, a seal 27 is attached to contact carrier 15.
- To form a radial seal, seal 27 has a plurality of circumferential, radially directed sealing lips 28, which are axially offset from one another.

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When joining both connectors 12, 13, sealing lips 28 are gripped by sleeve-shaped flange 26 of second connector 13 and are partially resiliently deflected at a side surface 29 of flange 26 in the axial direction, in the opposite direction of arrow 17. Thus, both connectors 12, 13 are sealed relative to each other by seal 27.

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In accordance with the deformability necessary for functionality, seal 27 is made of a soft, elastic material, so that given vibrational stresses of plug connection 11, the seal is not able to prevent undesired relative movements between coupled connectors 12, 13 due to vibrational stresses and due to the different masses of both connectors 12, 13.

To rigidly couple connectors 12, 13 also under vibrational stresses, a first pressing element 31 and a second pressing element 32 are provided. First pressing element 31, which is represented in the figures in a superelevated manner, is formed as a circumferential protuberance of contact carrier 15, which is made of an inherently stable plastic, and forms one piece with the contact carrier. In this context, the pressing element protrudes from a sidewall 33 of contact carrier 15 in a radial direction and partially projects into receiving slot 24 such that when inserting flange 26 into receiving slot 24, the pressing element is radially pressed against side surface 29 in the end segment of flange 26.

Alternatively, the circumferential extent of first pressing element 31 can be partially interrupted and can form single pressing regions, the pressing regions also being able to be re-formed into individual pressing points, so-called pressing warts.

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Second pressing element 32 is situated at the closed end of receiving slot 24 and is formed as a circumferential ring having rectangular cross-sectional areas. Second pressing element 32 is made of a hard rubber and has a Shore hardness of at least 60. At the end of the coupling operation of both connectors 12, 13, second pressing element 32 receives an end face 34 at the free end of flange 26 under axially directed pressing tension.

As a result of pressing elements 31, 32, both connectors 12, 13 are radially as well as axially biased relatively to each other after the completed coupling process. In this manner, both connectors 12, 13 form a one-piece unit, which can, however, be detached as needed. This one-piece design transfers to contact elements 18 and contact parts 21, which are situated in connectors 12, 13, and whose connection is fixed in the same manner.

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As a result of contact elements 18 being connected in a stable manner to contact parts 21, functionality-threatening relative movements between contact elements 18 and contact parts 21 in response to vibrational stresses acting on plug connection 11 are reduced to being uncritical, so that plug connection 11 remains functionally stable even under these unfavorable operating conditions. As a result, it is possible to attach plug connection 11 directly to an aggregate of an internal combustion engine.

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Abstract

A multipole electrical plug connection is to be designed in such a manner that it remains functionally stable even under vibrational stresses, in particular during the operation of an internal combustion engine.

The plug connection (11) is formed by coupling a first connector (12) to a second connector (13). Attached to a contact carrier (15) as part of a housing (14) of the first connector (12) are a first pressing element (31) and a second pressing element (32), via which the two connectors (12, 13) are radially and axially biased when both connectors (12, 13) are joined. As a result, relative movements between the contacted contact elements (18) and contact parts (21) situated in the fixed connectors (12, 13) are prevented.

The plug connection (11) is preferably intended for use in automobile manufacturing.

(Figure 2)